WHAT IS CLAIMED IS:

1. A microfluidic device comprising:

(a) an electronic component comprising a substrate having a surface, a layer of electrically-conductive material deposited on a portion of the substrate surface, and a layer of insulating material deposited on the layer of electrically-conductive material and the substrate surface, wherein the layer of insulating material has a substantially planar surface opposite the substrate surface; and

(b) a fluid-handling component having a contoured first surface and a second surface opposite the contoured first surface, wherein the contoured first surface of the fluid-handling component is affixed to the layer of insulating material on the electronic component, thereby forming one or a plurality of cavities between the electronic component and the fluid-handling component, and wherein the electrically-conductive material is in electrical or thermal communication with said cavities formed between the electronic component and the fluid-handling component.

2. The device of Claim 1 wherein the substrate is glass, silicon or plastic.

3. The device of Claim 1 wherein the electrically-conductive material is titanium, platinum, gold, or a combination thereof.

4. The device of Claim 1 wherein the layer of electrically-conductive material comprises a plurality of sublayers of electrically-conductive material.

5. The device of Claim 4 wherein the layer of electrically-conductive metal comprises a titanium sublayer deposited on a portion of the substrate surface, a platinum sublayer deposited on the titanium sublayer, and a gold sublayer deposited on the platinum sublayer.

6. The device of Claim 1 wherein the layer of insulating material is a biocompatible material.

7. The device of Claim 1 wherein the layer of insulating material comprises a plurality of sublayers of insulating material.

8. The device of Claim 7 wherein one sublayer of insulating material is a planarizing material.

9. The device of Claim 7 wherein the layer of insulating material comprises a first sublayer of tetraethylorthosilicate, a second sublayer of spin-on glass deposited on the first sublayer, and a third sublayer of tetraethylorthosilicate deposited on the second sublayer.

10. The device of Claim 2 wherein the substrate is silicon, further comprising a second layer of insulating material deposited on the substrate surface between the substrate surface and the layer of electrically-conductive material.

11. The device of Claim 10 wherein the second layer of insulating material is a material with good conformal properties.

12. The device of Claim 11 wherein the second layer of insulating material is tetraethylorthosilicate.

13. The device of Claim 1 wherein the fluid-handling component is composed of glass, silicon, plastic, quartz, sapphire, an epitaxial material or a polymer.

14. The device of Claim 13 wherein the fluid-handling component is composed of polydimethylsiloxane.

15. The device of Claim 1 further comprising an electrode extending through the layer of insulating material, wherein the electrode is in electrical communication with the embedded conductor.

16. The device of Claim 15 wherein the electrode is composed of gold, platinum or titanium.

17. The device of Claim 15 wherein the cavity between the electronic component and the fluid-handling component comprises a pattern of microchannels, and wherein the electrode extends into the pattern of microchannels.

18. The device of Claim 1 wherein at least one of the cavities between the electronic component and the fluid-handling component comprises a reaction chamber.

19. The device of Claim 1 wherein the fluid-handling component is affixed to the electronic component by anodic bonding.

20. The device of Claim 1 further comprising a layer of silicon deposited on the layer of insulating material.

21. A method for fabricating a microfluidic device comprising the steps of:

(a) generating a pattern for depositing a electrically-conductive material on a surface of a substrate of a electronic component;

(b) depositing a layer of electrically-conductive material on a portion of the substrate surface defined by the generated pattern;

(c) depositing a layer of insulating material on the substrate surface and the layer of electrically-conductive metal; and

(d) fabricating a fluid-handling component having a contoured first surface and a second surface opposite the contoured first surface; and

(e) affixing the contoured first surface of the fluid-handling component to the electrically-insulating layer on the electronic component.

22. A microfluidic device fabricated according to the following method:

(a) generating a pattern for depositing a electrically-conductive material on a surface of a substrate of a electronic component;

(b) depositing a layer of electrically-conductive material on a portion of the substrate surface defined by the generated pattern;

(c) depositing a layer of insulating material on the substrate surface and the layer of electrically-conductive metal; and

(d) fabricating a fluid-handling component having a contoured first surface and a second surface opposite the contoured first surface; and

(e) affixing the contoured first surface of the fluid-handling component to the electrically-insulating layer on the electronic component.

23. The method of Claim 21 wherein the step of generating a pattern for depositing electrically-conductive material comprises photolithography.

24. The method of Claim 21 further comprising the steps of

(a) generating a pattern for depositing a material for an electrode on the layer of insulating material;

(b) removing the portion of the electrically-insulating layer covered by the pattern for depositing the electrode material, thereby forming a trench extending through the electrically-insulating layer and exposing the layer of electrically-conductive material;

(c) depositing a layer of electrode material in the trench, thereby forming a electronic component comprising the substrate, the layer of electrically-conductive metal, the layer of insulating material and the electrode.

25. The process of Claim 21 wherein the step of generating the pattern for depositing the electrode material comprises photolithography.

26. The method of Claim 21 further comprising the step of depositing a layer of silicon on the layer of insulating material between the layer of insulating material and the fluid-handling component, wherein the contoured surface of the fluid-handling component is affixed to the layer of silicon on the electronic component.

27. The method of Claim 21 wherein the step of fabricating the fluid-handling component comprises the steps of:

(a) creating a mold pattern on a second substrate;

(b) depositing a material for the fluid-handling component on the mold pattern;

(c) allowing the fluid-handling component material to harden; and

(d) removing the hardened fluid-handling component material from the mold.

28. The method of Claim 27 wherein the step of creating a mold pattern on the second substrate comprises photolithography.

29. The method of Claim 21 wherein the step of fabricating the fluid-handling component comprises the steps of:

(a) creating an etching pattern on a second substrate; and

(b) etching the second substrate to form the contoured surface.

30. The method of Claim 29 wherein the step of creating an etch pattern on the second substrate comprises photolithography.

31. The process of Claim 21 wherein the step of fabricating a fluid-handling component comprises:

(a) depositing a layer of metal on a second substrate;

(b) forming a pattern on the layer of metal

(c) removing the portion of the metal layer covered by the pattern;

(d) forming at least one cavity in the second substrate, wherein the opening of the cavity corresponds to the portion of the metal layer that was removed in step (c); and

(e) removing the hardened fluid-handling component material from the mold pattern.

32. The process of Claim 31 wherein the step of forming a pattern on the layer of metal comprises photolithography.

33. A process for fabricating a microfluidic device comprising the steps of:

(a) generating a pattern for depositing a electrically-conductive material on a surface of a substrate of a electronic component;

(b) depositing a layer of electrically-conductive material on a portion of the substrate surface defined by the generated pattern;

(c) depositing a first sublayer of insulating material on the substrate surface and the layer of electrically-conductive metal;

(d) depositing a second sublayer of insulating material on the first layer of insulating material;

(e) depositing a third sublayer of insulating material on the second sublayer of insulating material;

(f) generating a pattern for depositing a material for an electrode on the third sublayer of insulating material;

(g) removing the portion of the third electrically-insulating sublayer, the second electrically-insulating sublayer and the first electrically-insulating sublayer covered by the pattern for depositing the electrode material, thereby forming a trench extending through the third electrically-insulating sublayer, the second electrically-insulating sublayer and the first electrically-insulating sublayer and exposing the layer of electrically-conductive material;

(h) depositing a layer of electrode material in the trench, thereby forming a electronic component comprising the substrate, the layer of electrically-conductive metal, the first sublayer of insulating material, the second sublayer of insulating material, the third sublayer of insulating material, and the electrode;

(i) fabricating a fluid-handling component having a contoured first surface and a second surface opposite the contoured first surface; and

(j) affixing the contoured first surface of the fluid-handling component to the second electrically-insulating layer on the electronic component.

34. A microfluidic device fabricated according to the following method:

(a) generating a pattern for depositing a electrically-conductive material on a surface of a substrate of a electronic component;

(b) depositing a layer of electrically-conductive material on a portion of the substrate surface defined by the generated pattern;

(c) depositing a first sublayer of insulating material on the substrate surface and the layer of electrically-conductive metal;

(d) depositing a second sublayer of insulating material on the first layer of insulating material;

(e) depositing a third sublayer of insulating material on the second sublayer of insulating material;

(f) generating a pattern for depositing a material for an electrode on the third sublayer of insulating material;

(g) removing the portion of the third electrically-insulating sublayer, the second electrically-insulating sublayer and the first electrically-insulating sublayer covered by the pattern for depositing the electrode material, thereby forming a trench extending through the third electrically-insulating sublayer, the second electrically-insulating sublayer and the first electrically-insulating sublayer and exposing the layer of electrically-conductive material;

(h) depositing a layer of electrode material in the trench, thereby forming a electronic component comprising the substrate, the layer of electrically-conductive metal, the first sublayer of insulating material, the second sublayer of insulating material, the third sublayer of insulating material, and the electrode;

(i) fabricating a fluid-handling component having a contoured first surface and a second surface opposite the contoured first surface; and

(j) affixing the contoured first surface of the fluid-handling component to the second electrically-insulating layer on the electronic component

35. The method of Claim 33 wherein the step of generating the pattern for depositing electrically-conductive material comprises photolithography.

36. The method of Claim 33 wherein the step of fabricating a fluid-handling component comprises photolithography.

37. The method of Claim 33 wherein the step of affixing the contoured surface of the fluid-handling component to the electrically-insulating layer of the electronic component comprises anodic bonding.